Department of Defense

Legacy Resource Management Program

PROJECT 14-764

Migratory connectivity of At-Risk grassland birds

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Camp Ripley 2015 Research Report

Executive Summary

In 2015, the Vermont Center for Ecostudies initiated an innovative grassland bird research project at Camp Ripley and five other military installations. Supported by the DoD Legacy Program, Project 14-764, contract no. W81EWF-4119-9496, this research is designed to elucidate the migratory pathways and wintering grounds of three At-Risk grassland bird species: Grasshopper Sparrows (*Ammodramus savannarum)*, Eastern Meadowlarks (*Sturnella magna*), and Upland Sandpipers (*Bartramia longicauda*). Understanding the entire annual cycle of migratory birds offers DoD installations an avenue for sharing the burden of protecting declining populations. Data collected from across the breeding range will provide insight into regional population connectivity, applicable to other installations that support grassland birds. In 2015 we exclusively focused our research efforts on Grasshopper Sparrows, but we will expand our efforts to Eastern Meadowlarks and Upland Sandpipers in 2016.

We banded and fit light-level geolocators onto male Grasshopper Sparrows from 4 May through 31 May, 2015. We searched all of the grasslands on Camp Ripley, but we only detected grassland birds on the airfield and the adjacent Emergency Vehicle Operators Course (EVOC)--where we consequently focused our research efforts. In total, we banded 37 male Grasshopper Sparrows, and deployed 30 geolocators on male Grasshopper Sparrows on Camp Ripley. We found nests of three species, and we conducted 34 point counts at 17 locations systematically placed across the airfield. Overall, we detected 29 species during point counts on Camp Ripley.

While the airfield and EVOC at Camp Ripley currently provides grassland bird habitat for Grasshopper Sparrows, few other grassland bird species were detected there. We did not detect grassland birds at any of the dozens of other grasslands that we surveyed down range at Camp Ripley. Several changes to the current management practices would likely tremendously benefit the grassland bird population at Camp Ripley which includes management to promote grass coverage and the removal of "shrub islands".

Project Background

The quantity and quality of grassland bird habitat has declined in North America during the last half century, and concurrently, grassland bird population declines have been among the steepest of all North American landbirds. More than 70% of grassland bird species declined significantly between 1966 and 2012, while only 7% have increased. Upland Sandpiper (*Bartramia longicauda*), Grasshopper Sparrow (*Ammodramus savannarum*), and Eastern Meadowlark (*Sturnella magna*) are three At-Risk migratory grassland bird species that commonly occur on military installations supporting substantial grasslands. Populations of Grasshopper Sparrow, a DoD PIF priority bird species, have dropped by 78% in the last 4 decades. Many states, particularly in the Northeast, have listed Grasshopper Sparrows as Threatened or Endangered. Upland Sandpiper populations have decreased substantially in some regions, including parts of the Midwest (IL, WI, MN, and MI), and in NY and other eastern states. It is Endangered, Threatened, or of Special Concern in five of eight Midwestern states and in most eastern states. The U.S. Fish and Wildlife Service considers Upland Sandpiper to be of national conservation concern due to population declines during the last century, and the U.S. Shorebird Conservation Plan lists Upland Sandpiper as a Species of High Concern. Eastern Meadowlark populations have experienced some of the most dramatic declines of grassland bird species. Their long-term population decline has resulted in a loss of 80% of the population since 1966, and this sharp decline has continued unabated even in recent years.

Until now, the understanding of migration and wintering ecology of most migratory songbirds has been extremely difficult, if not intractable. Managers have necessarily managed breeding populations with sparse, if any, knowledge of the limitations imposed on those populations during the rest of the year. Stable isotopes can provide us with clues for some species, but entail many uncertainties. New, powerful tools have emerged that allow researchers to document the daily movements of birds throughout an entire year. For a bird as small as a Grasshopper Sparrow, light-level geolocators can now provide latitude and longitude estimates for each day of its life through an entire year, and larger birds like Eastern Meadowlark can carry GPS geolocators that provide precise (within 500 m) location fixes for up to 30 programmable dates, downloaded via satellite onto a computer. For a species as large as Upland Sandpiper, we now have the capability of accurately tracking (with 500 m resolution) their every move each day, all year, using battery- and solar-powered GPS technology. With this revolutionary advancement, researchers can accurately track a bird during migration and winter, and they can record fine-scale movements in and around breeding areas. By using the latest state-of-the-art technology available, we will not need to recapture Eastern Meadowlarks or Upland Sandpipers to retrieve data.

These technologies will allow us to record wintering areas and to track the timing and routes of an individual bird's migration. We will be able to determine whether these characteristics differ among breeding populations, with implications for where and how a species may be threatened. The data will provide managers with dramatic new insight into the potential limitations and

threats faced by migratory birds throughout their annual cycle, allowing them to forge new partnerships to address these issues.

Military Mission Benefits

Conservation of natural resources on DoD lands is ultimately necessary to sustain the military training mission by ensuring the long-term availability of training lands (i.e., appropriate habitat conditions). In addition to serving its own mission, conservation fulfills the DoD's obligation, as required by the Migratory Bird Treaty Act, the Readiness Rule, Executive Order 13186, and the Sikes Act, to protect and conserve migratory birds on installations through research, habitat management, partnerships, and education. For all of these reasons, management personnel largely focus on conserving birds and their habitat on installations. Managers can use these resources more efficiently and effectively if there is an understanding of the events that affect migratory birds during their entire life cycle, rather than only during the 3-4 month-long breeding season.

Upland Sandpiper, Grasshopper Sparrow, and Eastern Meadowlark are top DoD priority species in part because they are rare and of high responsibility for DoD. Furthermore, these species are the most likely of grassland bird species to affect or to be in conflict with training activities--further underscoring the need to understand their year-round ecology. We know little about the ecology of these species outside of the breeding season, and therefore the weight of responsibility has fallen entirely on land managers on the breeding grounds, such as DoD, for maintaining populations. Knowledge of the non-breeding ecology of these species will help spread the weight of responsibility to partners, present and future, at migration stopovers and wintering grounds. Addressing threats to these species off the breeding grounds will help the DoD maximize efficacy of breeding season management on installations. Additionally, it will provide opportunities to develop partnerships and enhance cross-cultural outreach with organizations responsible for these same species on migratory and wintering grounds.

By building on grassland bird research previously funded by Legacy, this project provides a rare opportunity to conserve At-Risk species using a "full life cycle" approach. We will complement Legacy-funded work that has assessed the breeding distribution, abundance, productivity, and overall demography of the same grassland bird species on some of the same military airfields (Legacy projects #10-381 and #11-408). Models developed from these breeding season studies have provided an essential means for determining best management practices to benefit birds on installations, but they have not been able to incorporate factors outside of the breeding season that contribute to population viability. Our results will discern where and when, outside of the breeding season, other factors may affect grassland bird populations on installations. Combined with information from Legacy-funded projects on breeding parameters, the data we collect will take the initial, essential steps in ultimately determining the extent to which populations are limited on and outside of military installations. For example, we can begin to address whether

populations that are more productive differ in their migration phenology, routes, or wintering grounds compared to less productive populations.

This project will also benefit from research outside of DOD, further extending the limits of our knowledge, and if DOD desires, maximizing the use of data collected. The Principal Investigator for this Legacy proposal is involved with a project at the University of Wisconsin to develop full life cycle models under different climate change scenarios for other grassland bird species; researchers could use these models as a basis for these three grassland bird species in the future. These novel exercises in full life cycle science and stewardship will serve as templates for other migratory bird species on installations and elsewhere.

The proposed research will directly benefit the six installations included in the study: Joint Base Cape Cod (MA), Patuxent River NAS (MD), Fort Riley (KS), Fort McCoy (WI), Camp Grafton Training Site (ND), and Camp Ripley (MN). In addition, our results will be applicable to other installations across the country. Because our study spans much of the breeding range of the focal species, any installations that support breeding populations of these species may infer the connectivity of migration and wintering grounds with populations breeding on their lands, based on patterns we find. For example, we will discern whether populations breeding in the East migrate and winter in different locations compared to populations in the Midwest. Assuming species behave on this scale, installations in the East can infer where "their" populations are most likely to winter. The list of installations to benefit from our results therefore includes all that support breeding populations of the three focal species. This includes but is not limited to: Hanscom AFB (MA), Fort Devens Army Base (MA), Massachusetts Military Reservation (MA), Warren AFB (WY), Fort Drum (NY), Fort Campbell (KY/TN), McConnell AFB (KS), Grand Forks AFB (ND), Minot AFB (ND), Fort Leavenworth (KS), and Fort Indiantown Gap (PA). These are only the installations that we investigated during our site selection process, a mere subsample of those that will benefit from our study.

Installations that serve as migratory stopovers or wintering areas for these grassland birds will also greatly benefit from knowledge of connectivity between breeding, migratory, and wintering populations. By making connections on a coarse scale between the migration routes and wintering areas of birds with their breeding origin, our study will allow managers to coordinate efforts that will support bird populations during different parts of the life cycle. For example, several Navy installations in Texas host wintering populations of Grasshopper Sparrow and meadowlark spp. Knowledge about where these populations hail from will allow managers to understand where management on the breeding grounds would have the greatest impact on "their" birds. Armed with this insight, installations on the breeding and wintering grounds can work in unison to identify and address the needs unique to the populations they share.

Knowledge of breeding origin and connectivity with wintering grounds will also assist managers at installations supporting migrating bird populations (e.g., Patuxent NAS hosts migrating Upland Sandpipers). By revealing migratory paths, the consistency of migratory stopover use,

the length of time spent at stopovers, and the duration and distance of flights before and after a stopover, we will shed light on how and when different stopover regions are used by migrating birds of different breeding origins. Is a particular installation in the path a commonly used migratory route for all breeding populations or only certain ones? Do the birds stop there prior to or just after a long leg of their migratory flight, suggesting that the food resources may be critical to a successful migration? With the technology we will employ, we will be able to address such questions for the first time.

In this second year (2016) of the project, we will be able to analyze location data from any geolocators that we retrieve from recaptured Grasshopper Sparrows. In 2016 we will also deploy four solar-powered GPS tags on Upland Sandpipers, and almost two dozen battery-powered GPS tags on Upland Sandpipers (22 tags) and Eastern Meadowlarks (20 tags). The battery-powered tags have sufficient battery to store location data for 30 pre-programmed dates, while the solar-powered tags have the ability to last up to 3 years. Based on our observations of grassland birds during the 2015 field season we plan to deploy these tags on Upland Sandpipers and Eastern Meadowlarks at Fort Riley, Fort McCoy, and Joint Base Cape Cod. The other three DoD installations (Camp Grafton, Camp Ripley, and Patuxent River NAS) either lack populations or have very low densities of Upland Sandpipers and Eastern Meadowlarks.

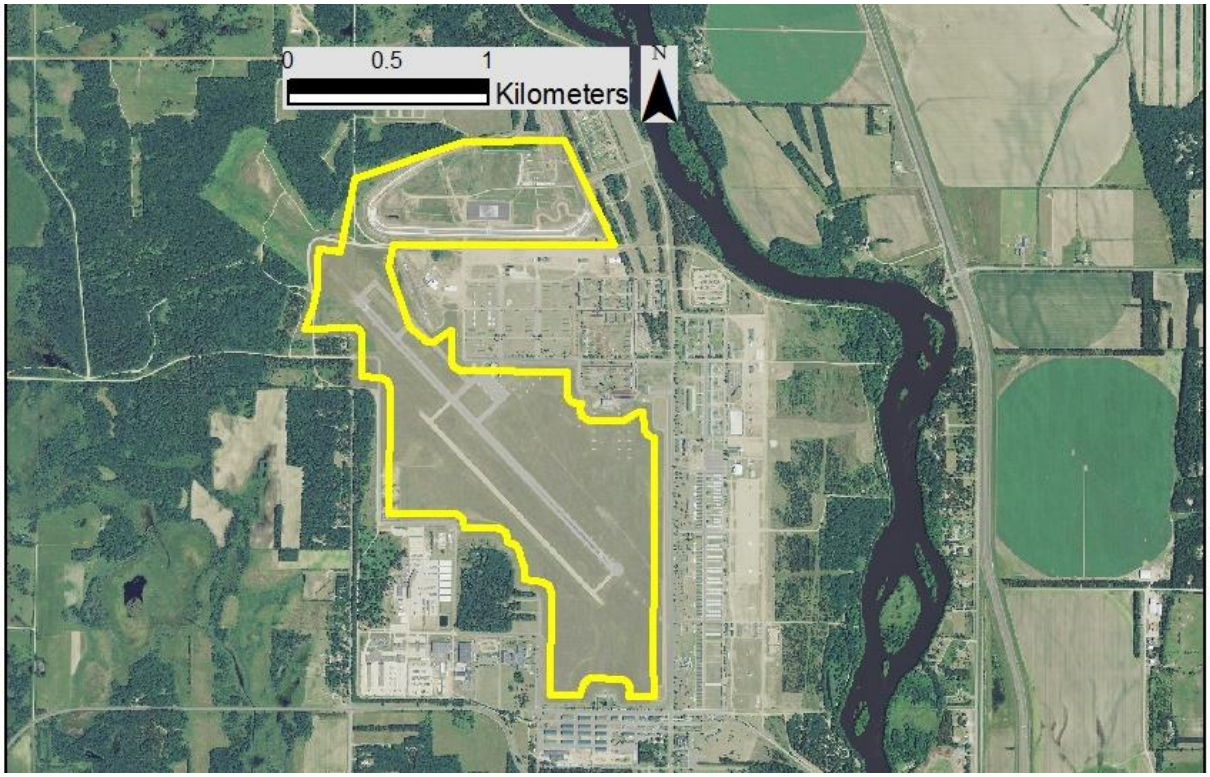
In 2018, we will issue recommendations directly relating to this proposal after we retrieve all data. These recommendations will differ from the typical land use management practices; they will identify where these installation-specific populations may be limited during migration and winter, and thus where land managers may share responsibility. Our recommendations will include a strategy for how and where the DOD, through its alliance with Partners in Flight (PIF), may forge and enhance partnerships on a broad scale in order to maximize positive management impact on grassland bird populations that breed on installations. Installations involved in the project will be advised as to 1) what entities, both military and non-military, they may coordinate with to manage grassland bird populations throughout their life cycle; 2) follow-up research questions or issues that may be helpful for managers; 3) any changes in field protocols that would be advisable or useful for future work using the new technology of geolocators.

Our project will take miniaturized technology to new limits: it will be the first to use light-level geolocators, Argos GPS technology, and PTTs on these grassland bird focal species. We will be able to ask questions that we have never before been able to address, and we will gain insights never before possible. This groundbreaking research will serve as a template for implementing tracking technology for other bird species on military lands throughout the United States. Most importantly, however, the DoD will be involved in a project that will help to transform our way of thinking about how migratory bird species management and partnerships can sustain the military training mission.

Survey & Capture Methods

Male Grasshopper Sparrows are more vocal, visible, and easier to capture, and have lower inter-annual dispersal rates than female Grasshopper Sparrows. Therefore, we exclusively targeted male Grasshopper Sparrows for light-level geolocator deployment. During the first three weeks of May we systematically visited grasslands throughout the down range area at Camp Ripley. During these grassland visits we walked transects across the grounds attempting to flush or encounter grassland bird species—especially Grasshopper Sparrows. Grasshopper Sparrows prefer areas of extensive grass cover >50 m from woodland edges with little woody vegetation and small areas of exposed ground. Our goal was to identify areas with high concentrations of Grasshopper Sparrows, so that we could deploy geolocators on males in a relatively small area. Marking males in one small area, as opposed to several scattered areas, will reduce the amount of land that we need to search in 2016 to relocate and recapture males wearing geolocators, because male Grasshopper Sparrows often shift their territories between years. Unfortunately we did not see or hear any Grasshopper Sparrows in any of the down range fields. After negotiation and consultation with the Military police and airfield staff we switched our focus to the airfield and adjacent EVOC area to the immediate north (Figure 1).

Figure 1. *Our main search area at Camp Ripley where we concentrated our capture, banding, and surveying efforts.*



Male Grasshopper Sparrow activity greatly increased during the last two weeks of May, and we began capture efforts on 15 May, 2015. Our capture efforts, however, were hindered by the very

short grass and lack of perches at the airfield. We rarely saw the birds, because the Grasshopper Sparrows sang almost exclusively from the ground. The sparrows' lack of flying off of the ground also made it difficult to tell if we were potentially targeting a recapture, so we mostly avoided areas in which we had already captured birds. Once we located a singing male sparrow we then set up a 6-m 30mm-mesh nylon mist net on 2-m tall poles (Figure 2). We then placed a small speaker, attached to a smartphone, 1-m away from the center of the net and broadcasted a recording of a male Grasshopper Sparrow song. Male Grasshopper Sparrows are territorial and they perceive the recorded song as an intruding male sparrow. Male sparrows generally flew up to the net and landed on the ground near the speaker. We then quickly approached the bird and encouraged the male to fly into the net. Occasionally male sparrows would fly into the net without encouragement from us. We limited the use of recordings to <5 min with any given male sparrow, and we generally targeted males between 0600 and 1030. This 4.5 hr period corresponds with the timing of copulation in this species, and males became noticeably less aggressive to our recorded intruder song after 1000. We also attempted to capture males in the evening hours (1730-2030), but males showed little interest in our playback during these hours.

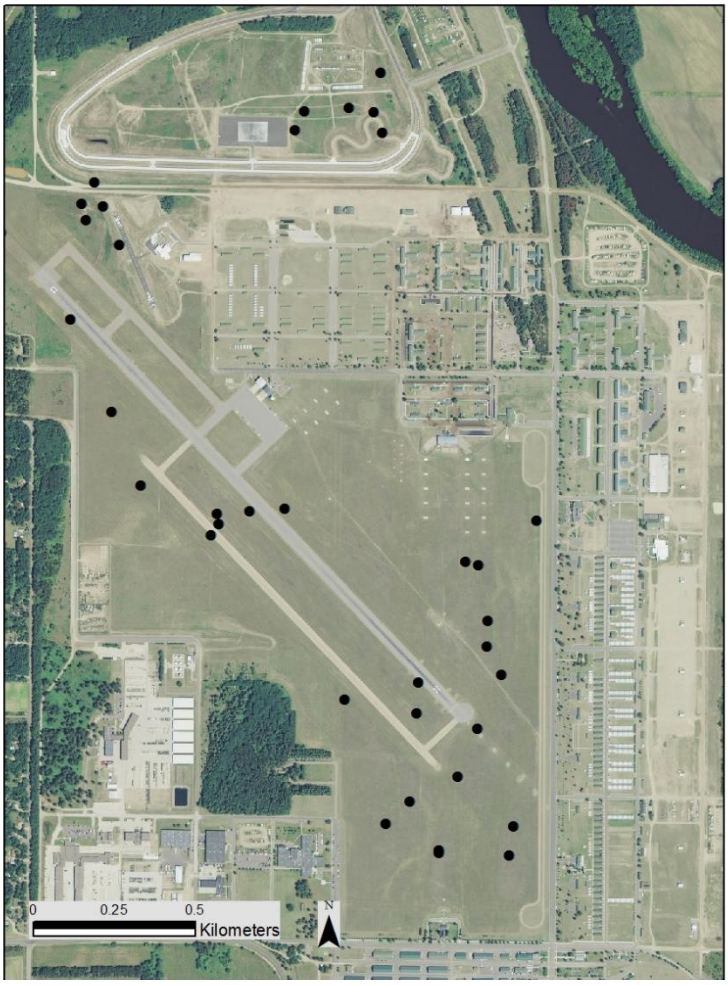
Figure 2. *Typical mist net set up used to capture male Grasshopper Sparrows at Camp Ripley, Minnesota. The vast majority of males were captured within 1 m of the ground.*

Banding, and Feather and Blood Sampling

We began banding on 15 May, 2015 and concluded our efforts on 27 May, 2015. For all captured birds we recorded their age, sex, weight, and basic morphological measurements (Figure 3). Handling time was generally less than 10 minutes per bird, and all birds were released unharmed at their capture location. During May, we successfully captured and banded 36 male Grasshopper Sparrows (Appendix A) on the airfield and EVOC areas (Figure 4). In collaboration with other researchers we also sampled a single primary (i.e., wing) feather and a small amount of blood (<100 µl) from birds that did not receive a geolocator. The feather samples will be used by colleagues in a stable isotope analysis to determine the diet of wintering Grasshopper Sparrows, and the blood samples will provide our colleagues with insight into internal parasite loads. We obtained feather samples from 6 birds, but we did not take any blood samples due to the cold temperatures during banding operations. We recaptured one individual on the same day that we initially captured it. The last seven Grasshopper Sparrows were captured on the Emergency Vehicle Operators Course.

Figure 3. *Alison Nevins removes a male Grasshopper Sparrow from the mist net on the airfield at Camp Ripley, Minnesota in May 2015.*

Figure 4. *Banding locations of all Grasshopper Sparrows captured at Camp Ripley, MN, during May, 2015.*



Geolocator Deployment and Color-banding

Birds wearing geolocators must be recaptured in 2016 to gain access to the geolocator data. To facilitate our future recovery efforts we attached a unique combination of color bands to the legs of a Grasshopper Sparrows fitted with a geolocator (Figure 5). The geolocator units are small (~0.5 g, including the harness) and are difficult to see on a moving bird. Color bands, however, are more visible and in 2016 these color band combos will allow us to quickly key in on birds wearing a geolocator. We made a simple loop harness for the geolocators using an 80.5 mm piece of Stretch Magic bead and jewelry cord (0.7 mm). We passed the material through the geolocator loops, and melted the ends of the cord together using a soldering iron. The resulting fused harnesses are strong, but also flexible so as to accommodate sparrows of varying body sizes.

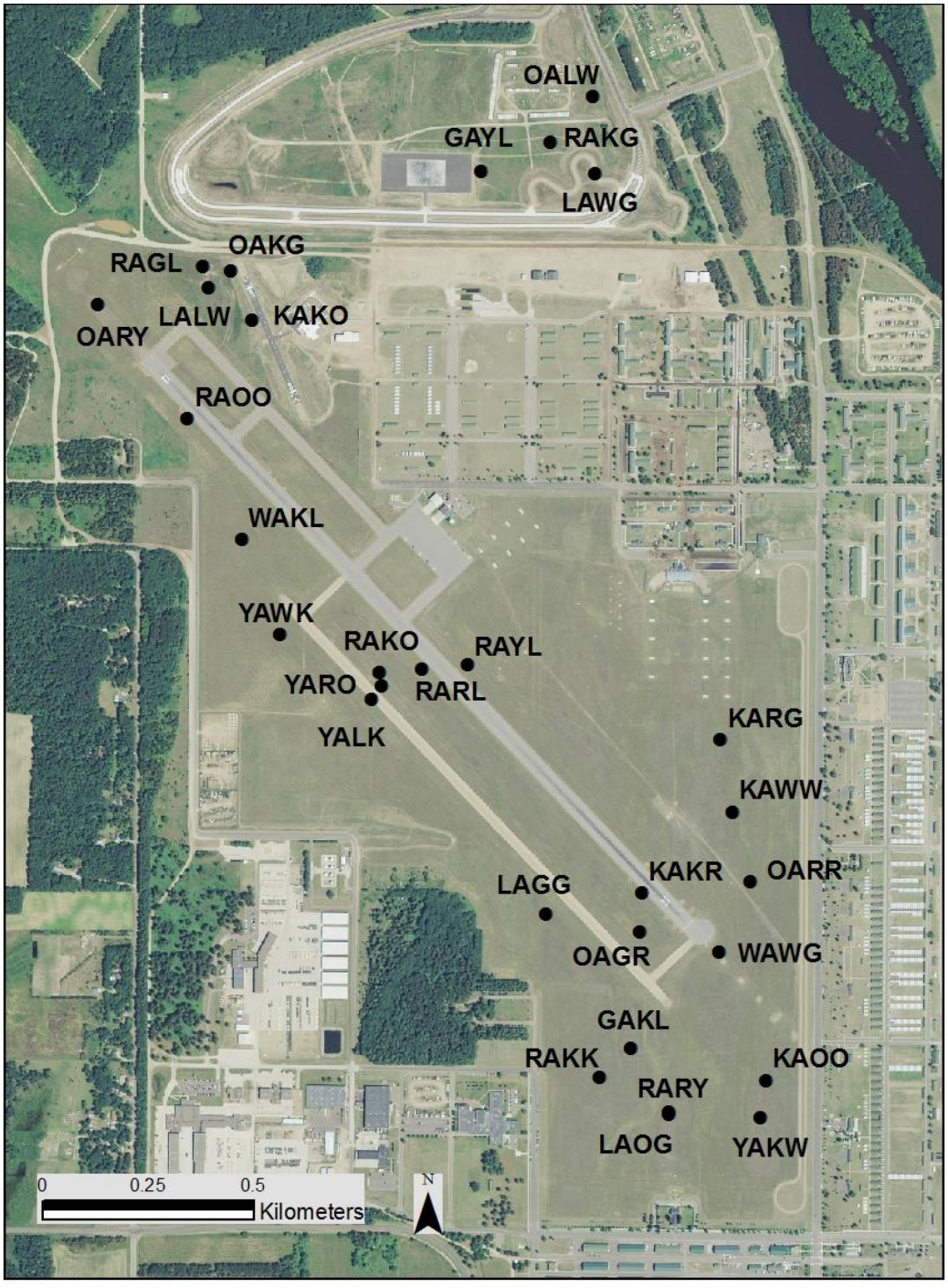
We only deployed geolocators on birds that weighed ≥17.0 g, so that the geolocator + harness weight did not exceed 3% of body mass. The geolocator harness slipped on over a bird's legs and

fit snugly over their hips. Once the geolocator was on the bird we checked the harness fit by measuring the amount of vertical play between the bird's back and the bottom of the geolocator when slight upwards force was applied to the geolocator. We deemed that the harness fit adequately if the play was 1-2 mm. We used a small piece of plastic to smooth the body feathers underneath the harness. Before releasing the bird we made sure that the harness fit securely, and that the wings and legs were free to move unimpeded. We also found it helpful to have a small crochet hook to pull the harness over the legs. The hook was also helpful to pull the feathers under the geolocator.

Figure 5. *Male Grasshopper Sparrow wearing a light-level geolocator (right panel) at Camp Ripley, Minnesota, May 2015. The light stalk of the geolocator is visible just to the right of the visible finger knuckle. This male was color-banded KAWW: black over aluminum on the right leg and white over white on the left leg.*

We color-banded 30 adult male Grasshopper Sparrows at Camp Ripley (Figure 6), and we deployed 30 geolocators (Appendix A). The color band combinations consist of an aluminum band (A) with three color bands of the following colors: red (R), white (W), blue (L), orange (O), green (G), black (K), violet (V), yellow (Y), and hot pink (H). The color band combinations are read in the following order: right leg top, right leg bottom, left le top, left leg bottom (Figure 6).

Figure 6. *Locations of all color-banded adult male Grasshopper Sparrows at Camp Ripley, May 2015. All of these birds were fitted with a geolocator.*



Post-deployment Observations

When we released birds wearing geolocators, most of the Grasshopper Sparrows would wobble in flight at first but then they would quickly correct for the new weight of the geolocator. In general, we tried to avoid areas where we had previously banded male Grasshopper Sparrows to avoid accidentally recapturing birds wearing geolocators. Male Grasshopper Sparrows wearing geolocators must be recaptured in subsequent years to acquire their data. Males may become weary of mist nets if they are captured frequently, which could hinder our recapture efforts in 2016. Due to the short grass and lack of perches on the airfield, we rarely saw any perched Grasshopper Sparrows. We only observed (i.e., re-sighted) one colored banded Grasshopper Sparrow, but we could not see the small geolocator on the bird's lower back. The male sparrow behaved naturally, and the geolocator did not affect the flight or behavior of the male.

Nesting Birds

Nest searching was not one of our main foci at Camp Ripley, but we did opportunistically discover bird nests. We recorded the location of these nests (Appendix B), but we did not monitor them. We did not find any Grasshopper Sparrow nests or see any behavior (e.g., food carrying) which would suggest evidence of a successful nesting attempt. When walking the various fields down range of Camp Ripley, we found a Wild Turkey (*Meleagris gallopavo*) nest, a likely Vesper Sparrow (*Pooecetes gramineus*) nest (Figure 7), and an unidentified duck nest (Anatidae sp.) that was likely a Mallard (*Anas platyrhynchos*).

Figure 7. *A likely Vesper Sparrow nest with four eggs discovered down range at Camp Ripley, Minnesota, May 2015.*

eBird Summary

All of our daily observations of birds were entered into eBird (www.ebird.org) [Table 1; Appendix C], which is an online database managed by Cornell University that has become an important resource about bird distribution and abundance for scientists, researchers, and amateur birders. eBird is entirely free and available to anyone with an internet connection, and has dramatically changed the way that the professional and amateur birding communities record and assess information about birds throughout the world. Essentially, an observer enters a checklist of the number of individuals seen of each species that they encounter while birding into eBird. The user plots their location on a map, records information about their effort (e.g., number of hours birded, and distance traveled, if any), and can provide comments about their observations or even upload photos. An expert local reviewer examines each observation to ensure a high level of integrity in the database. In May 2015, for example, users around the world submitted >9.5 million bird observations.

Table 1. *Summary of our eBird avian observation data from Camp Ripley, May 1 through May 31, 2015 which includes the number of checklists submitted and the number of species and individuals detected.*

	May 1-5	May 6-10	May 11-15	May 16-20	May 21-25	May 26-31
No. of species	24	39	18	9	12	15
No. of individuals	61	173	98	83	75	173
No. of checklists	2	11	17	5	6	3

Point Count Summary

We conducted point count surveys at 17 locations in the general vicinity where we deployed geolocators on male Grasshopper Sparrows (Figure 8). Camp Ripley contains a substantial amount of grasslands "down range" but we did not encounter any grassland birds there during our scouting efforts. Surveying such a large area would likely take a dedicated crew working for the entire summer. Rather than sample the entire grassland complex at Camp Ripley we chose to sample grassland birds in the 175-ha area of the airfield where we performed the majority of our research. We did not conduct point counts in the EVOC area due to security and logistical constraints. By focusing on the airfield we were able to much more effectively sample the grassland bird population at Camp Ripley.

Each point was surveyed twice, by different observers, on different days: 27 and 29 May, 2015. Point count locations were a minimum of 0.30 km apart. Over the course of five minutes a lone observer counted all individual birds that were detected by either sight or sound within an unlimited distance from the point. In practice, however, most individual birds were detected within 100 m of the observer. No audio recordings or decoys of any kind were used to increase the detection of individuals. We made every effort to avoid double-counting individual birds (e.g., a soaring hawk) across multiple point count locations. Each count started immediately as the observer arrived at the point count location, and all points were surveyed between 0530 and 900. In total, 29 bird species were detected during the point counts (Appendix D). Grasshopper Sparrow and Horned Lark (*Eremophila alpestris*) were the most frequently detected species, and were all detected on 76% of our point counts.

Grasshopper Sparrows were most abundant at point count stations 1, 3, 16, and 17 (Figure 9), while all grassland birds combined (*including Grasshopper Sparrow, Western Meadowlark [Sturnella neglecta], Killdeer [Charadrius vociferus], Horned Lark, Vesper Sparrow [Pooecetes gramineus], American Goldfinch [Carduelis tristis], and Eastern Kingbird [Tyrannus tyrannus]*) were more abundant at point count stations 5, 7, and 13 (Figure 10).

Figure 8. *Point count locations were systematically located within the airfield area of Camp Ripley where we deployed geolocators (yellow polygon).*

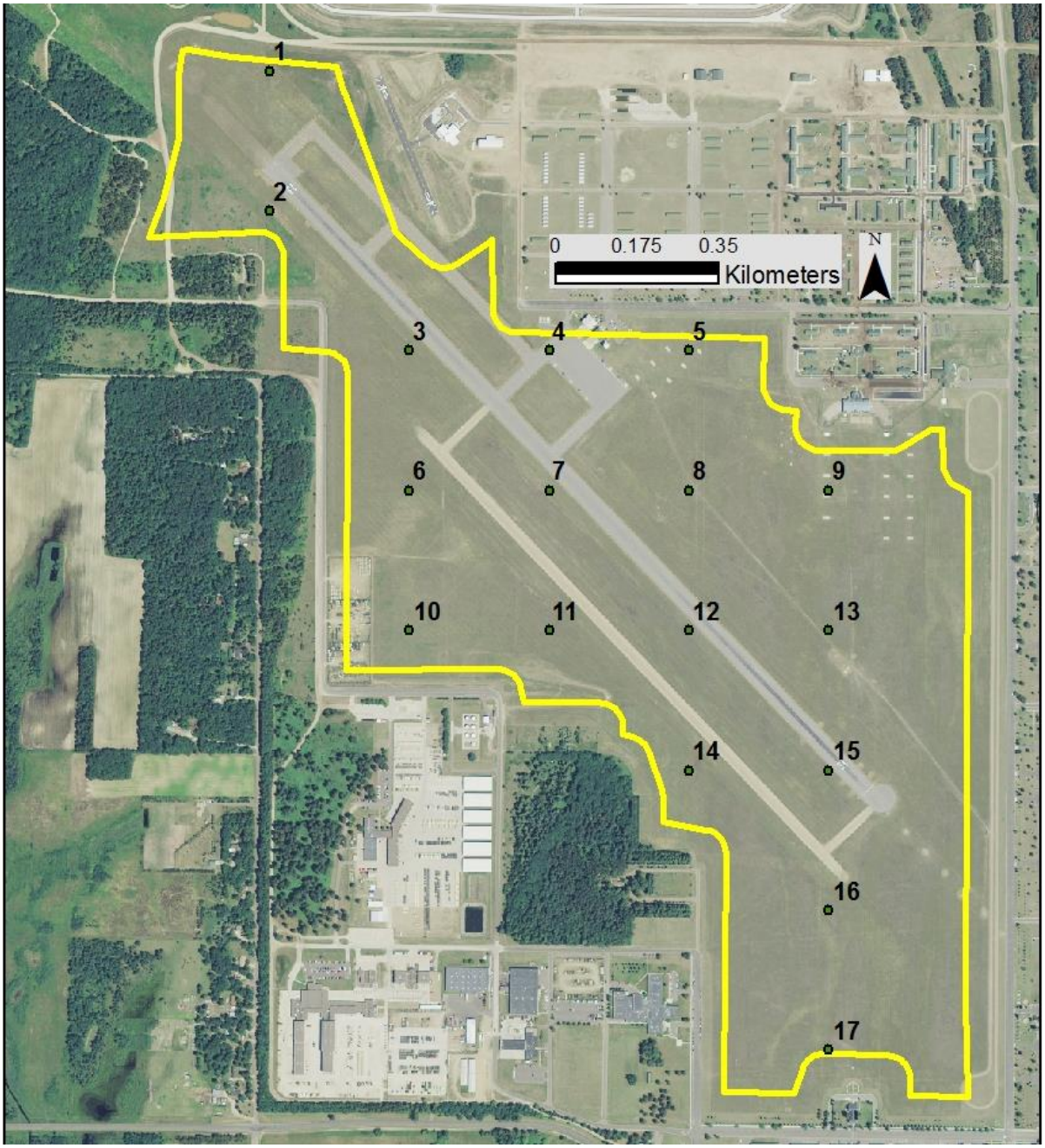


Figure 9. *The mean number of Grasshopper Sparrows detected on a point count in the 100-m area surrounding each point count location on Camp Ripley.*

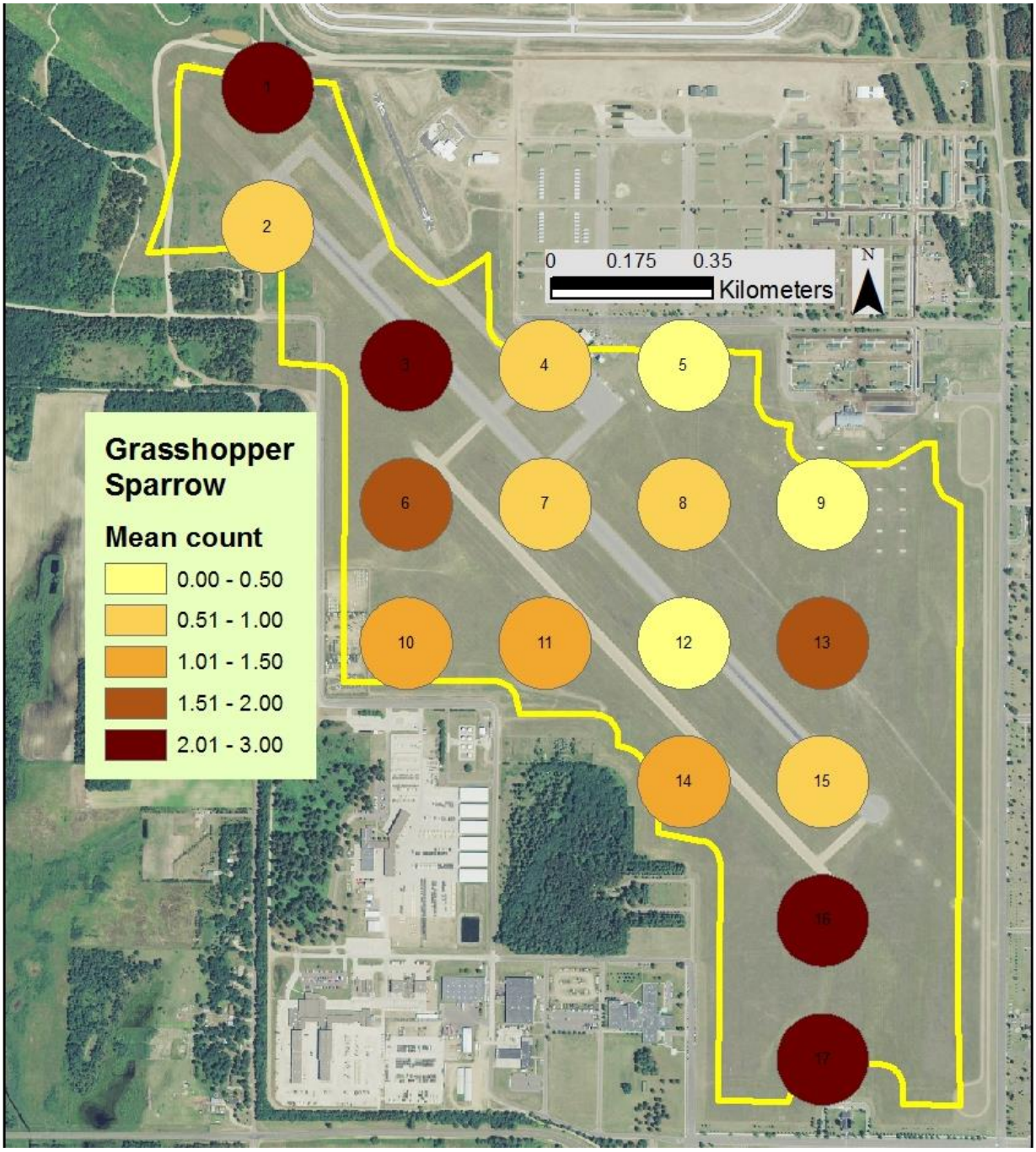
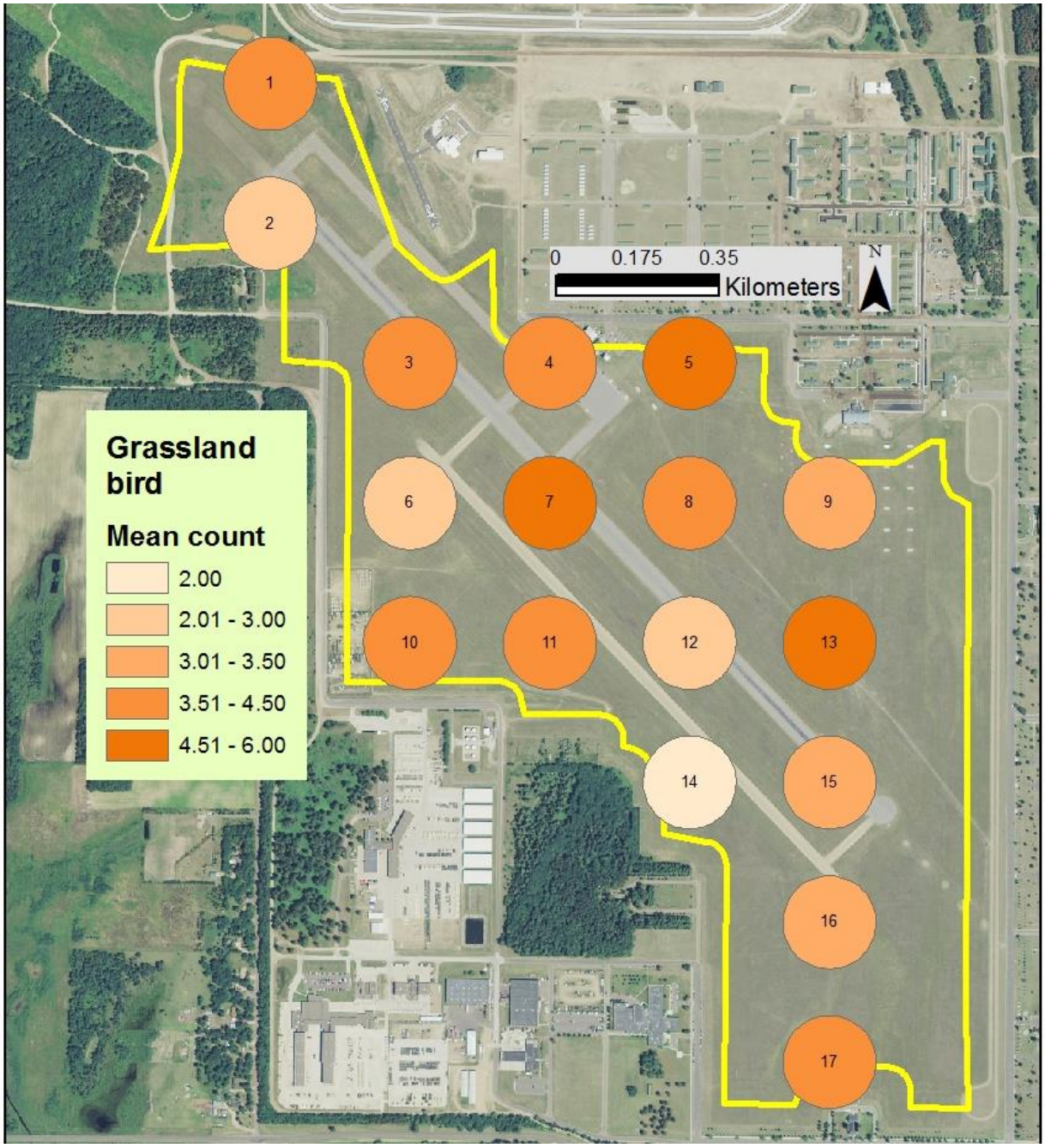


Figure 10. The mean number of individual grassland birds (including Grasshopper Sparrow, Western Meadowlark [Sturnella neglecta], Killdeer [Charadrius vociferus], Horned Lark, Vesper Sparrow [Pooecetes gramineus], American Goldfinch [Carduelis tristis], and Eastern Kingbird [Tyrannus tyrannus]) detected on a point count in the 100-m area surrounding each point count location at Camp Ripley.



Habitat Management Recommendations

Camp Ripley is a large and active training area with a variety of habitats: deciduous forests, early successional scrub-shrub, and grasslands. As explained to us in our multiple meetings with Tim Notch and Brian Dirks, the down range area is open to public access, including hunting and firewood collection, and also hosts a substantial number of training exercises each year. While considerable grassland habitat exists in the down range area their small size and irregular shape, and presence of shrub and tree islands have reduced the suitability of these lands for grassland birds. For example, in field 31 down range there are strips of trees that extend out into the grassland. Some simple chainsaw or mowing work could eliminate these strips of trees and greatly improve the chances that grassland birds will occupy field 31 in the future.

In our surveys we found grassland birds almost exclusively restrained to the EVOC and airfield areas. Major Foster informed us that current airfield management is designed to discourage grassland birds from nesting to avoid airplane strikes. Major Foster achieves this goal by keeping the grass short and by mowing throughout the summer. Restricting mowing activities to June and July and leaving at least six inches of grass would likely greatly benefit the existing and prevalent Grasshopper Sparrow population without compromising avian safety. For example, Joint Base Cape Cod and Westover Air Force Base successfully maintain airfield safety while providing habitat for Grasshopper Sparrows, Eastern Meadowlarks, and Upland Sandpipers on their airfields.

Lessons Learned

Unforeseen events will affect any research project of this size and scope, but for the most part, we were very fortunate at Camp Ripley in 2015. Compared to some of our other partner installations (e.g., Fort Riley, KS), we did not have access to as thorough bird data from eBird or military personnel for the Camp Ripley area. This caused us to guess as to the arrival dates of Grasshopper Sparrows, and we arrived approximately 10 days before breeding activity kicked into full gear. During these 10 days, we were largely unsuccessful at capturing Grasshopper Sparrows, so instead we focused on scouting for high-quality sections of grassland during this time. There is a substantial acreage of grassland at Camp Ripley, but nearly all of the parcels lacked grassland birds. It took substantially more time than we anticipated identifying areas with grassland birds. Scouting in 2014 could have preemptively identified this situation.

We had originally planned to deploy satellite tags on Upland Sandpipers and Eastern Meadowlarks in 2016, but we will not be following through with that plan. We expected to find greater numbers of Upland Sandpipers and meadowlarks at Camp Ripley than we did in 2015. The lessons learned are to have backup sites already identified in the event that one site falls through, and to thorough check out sites in the year prior to the commencement of research activities. In our case, we already knew that three of our six sites (Fort Riley, Joint Base Cape Cod, and Fort McCoy) had sizable populations of sandpipers and meadowlarks, so removing

Camp Ripley from our list of Upland Sandpiper and Eastern Meadowlark sites will not affect our research.

Acknowledgments

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Appendix A: Grasshopper Sparrow banding data from Camp Ripley, Minnesota (May, 2015)

Capture date	UTMS Easting	UTMS Northing	Disposition	Band number	Color band combo	Fitted with a geolocator?	Blood taken?	Feather collected?	Age	Sex
5/24/2015	395329	5104117	New	222152819	GAKL	Yes			Adult	Male
5/27/2015	394975	5106191	New	222151836	GAYL	Yes			Adult	Male
5/22/2015	394432	5105838	New	222152813	KAKO	Yes			Adult	Male
5/24/2015	395356	5104485	New	222152823	KAKR	Yes			Adult	Male
5/20/2015	395650	5104041	New	222152805	KAOO	Yes			Adult	Male
5/26/2015	395542	5104847	New	222152830	KARG	Yes			Adult	Male
5/26/2015	395570	5104676	New	222152829	KAWW	Yes			Adult	Male
5/15/2015	395128	5104434	New	222152801	LAGG	Yes			Adult	Male
5/22/2015	394330	5105915	New	222152814	LALW	Yes			Adult	Male
5/26/2015	395419	5103960	New	222152826	LAOG	Yes			Adult	Male
5/27/2015	395245	5106185	New	222152832	LAWG	Yes			Adult	Male
5/24/2015	395352	5104391	New	222152822	OAGR	Yes			Adult	Male
5/22/2015	394384	5105957	New	222152811	OAKG	Yes			Adult	Male
5/27/2015	395239	5106369	New	222152835	OALW	Yes			Adult	Male
5/22/2015	394067	5105876	New	222152809	OARY	Yes			Adult	Male
5/24/2015	395612	5104510	New	222152825	OARR	Yes			Adult	Male
5/22/2015	394317	5105965	New	222152810	RAGL	Yes			Adult	Male
5/23/2015	394736	5105006	New	222152816	RAKO	Yes			Adult	Male
5/24/2015	395257	5104048	New	222152818	RAKK	Yes			Adult	Male
5/27/2015	395141	5106261	New	222152833	RAKG	Yes			Adult	Male
5/21/2015	394281	5105607	New	222152808	RAOO	Yes			Adult	Male
5/23/2015	394836	5105014	New	222152815	RARL	Yes			Adult	Male
5/26/2015	395420	5103966	New	222152827	RARY	Yes			Adult	Male
5/23/2015	394944	5105024	New	222152817	RAYL	Yes			Adult	Male
5/21/2015	394409	5105321	New	222152807	WAKL	Yes			Adult	Male
5/24/2015	395539	5104344	New	222152821	WAWG	Yes			Adult	Male
5/26/2015	395637	5103952	New	222152828	YAKW	Yes			Adult	Male
5/16/2015	394717	5104942	New	222152803	YALK	Yes			Adult	Male
5/15/2015	394740	5104975	New	222152802	YARO	Yes			Adult	Male
5/21/2015	394499	5105095	New	222152806	YAWK	Yes			Adult	Male
5/20/2015	395722	5104985	New	222152804	None		Yes	Yes	Adult	Male
5/22/2015	394356	5106030	New	222152812	None		Yes	Yes	Adult	Male
5/24/2015	395477	5104194	New	222152820	None		Yes	Yes	Adult	Male
5/24/2015	395568	5104596	New	222152824	None		Yes	Yes	Adult	Male
5/27/2015	395501	5104859	New	222152831	None		Yes	Yes	Adult	Male
5/27/2015	395219	5106249	New	222152834	None		Yes	Yes	Adult	Male
5/27/2015	395004	5106250	Recapture	222152834	None				Adult	Male

Appendix B: Nests discovered at Camp Ripley, Minnesota (May, 2015)

Species	Date discovered	Nest contents	UTM Easting zone 15	UTM Northing zone 15
Wild Turkey (*Meleagris gallopavo*)	5/8/2015	17 eggs	396334	5124949
Anas spp.	5/5/2015	7 eggs	393984	5115142
Vesper Sparrow (*Pooecetes gramineus*)	5/22/2015	4 eggs	388019	5125041

Appendix C: List of bird species reported to eBird for Camp Ripley (May, 2015)
Species
Canada Goose (Branta canadensis)
Trumpeter Swan (Cygnus buccinator)
Trumpeter/Tundra Swan (Cygnus buccinator/columbianus)
Wood Duck (Aix sponsa)
Mallard (Anas platyrhynchos)
dabbling duck sp. (Anas sp.)
Hooded Merganser (Lophodytes cucullatus)
Common Merganser (Mergus merganser)
Wild Turkey (Meleagris gallopavo)
Common Loon (Gavia immer)
American White Pelican (Pelecanus erythrorhynchos)
Great Blue Heron (Ardea herodias)
Turkey Vulture (Cathartes aura)
Accipiter sp. (Accipiter sp.)
Bald Eagle (Haliaeetus leucocephalus)
Red-tailed Hawk (Buteo jamaicensis)
Killdeer (Charadrius vociferus)
Upland Sandpiper (Bartramia longicauda)
Mourning Dove (Zenaida macroura)
Black-billed Cuckoo (Coccyzus erythropthalmus)
Red-bellied Woodpecker (Melanerpes carolinus)
Yellow-bellied Sapsucker (Sphyrapicus varius)
Northern Flicker (Colaptes auratus)
American Kestrel (Falco sparverius)
Eastern Phoebe (Sayornis phoebe)
Great Crested Flycatcher (Myiarchus crinitus)
Western Kingbird (Tyrannus verticalis)
Red-eyed Vireo (Vireo olivaceus)
Blue Jay (Cyanocitta cristata)
American Crow (Corvus brachyrhynchos)
Horned Lark (Eremophila alpestris)
Tree Swallow (Tachycineta bicolor)
Barn Swallow (Hirundo rustica)
Cliff Swallow (Petrochelidon pyrrhonota)
Black-capped Chickadee (Poecile atricapillus)
Red-breasted Nuthatch (Sitta canadensis)
White-breasted Nuthatch (Sitta carolinensis)
Eastern Bluebird (Sialia sialis)
American Robin (Turdus migratorius)
Brown Thrasher (Toxostoma rufum)
Ovenbird (Seiurus aurocapilla)

Appendix C: List of bird species reported to eBird for Camp Ripley (May, 2015) Species
Golden-winged Warbler (Vermivora chrysoptera)
Nashville Warbler (Oreothlypis ruficapilla)
American Redstart (Setophaga ruticilla)
Palm Warbler (Setophaga palmarum)
Yellow-rumped Warbler (Setophaga coronata)
Chipping Sparrow (Spizella passerina)
Clay-colored Sparrow (Spizella pallida)
Field Sparrow (Spizella pusilla)
Vesper Sparrow (Pooecetes gramineus)
Savannah Sparrow (Passerculus sandwichensis)
Grasshopper Sparrow (Ammodramus savannarum)
Song Sparrow (Melospiza melodia)
Lincoln's Sparrow (Melospiza lincolnii)
Harris's Sparrow (Zonotrichia querula)
Rose-breasted Grosbeak (Pheucticus ludovicianus)
Red-winged Blackbird (Agelaius phoeniceus)
Eastern Meadowlark (Sturnella magna)
Western/Eastern Meadowlark (Sturnella sp.)
Brown-headed Cowbird (Molothrus ater)
American Goldfinch (Spinus tristis)

Appendix D: Point count data summary for Camp Ripley, Minnesota (May, 2015)		
Species	Individuals detected	Detection rate (%)
Canada Goose (Branta canadensis)	4	11.8
Killdeer (Charadrius vociferus)	5	14.7
Red-bellied Woodpecker (Melanerpes carolinus)	1	2.9
American Kestrel (Falco sparverius)	1	2.9
Least Flycatcher (Empidonax minimus)	1	2.9
Eastern Kingbird (Tyrannus tyrannus)	1	2.9
Yellow-throated Vireo (Vireo flavifrons)	1	2.9
Blue-headed Vireo (Vireo solitarius)	1	2.9
Red-eyed Vireo (Vireo olivaceus)	3	8.8
Blue Jay (Cyanocitta cristata)	3	8.8
American Crow (Corvus brachyrhynchos)	18	52.9
Horned Lark (Eremophila alpestris)	26	76.5
Tree Swallow (Tachycineta bicolor)	2	5.9
Barn Swallow (Hirundo rustica)	4	11.8
White-breasted Nuthatch (Sitta carolinensis)	1	2.9
American Robin (Turdus migratorius)	3	8.8
Gray Catbird (Dumetella carolinensis)	1	2.9
Ovenbird (Seiurus aurocapilla)	5	14.7
Common Yellowthroat (Geothlypis trichas)	1	2.9
Chipping Sparrow (Spizella passerina)	4	11.8
Field Sparrow (Spizella pusilla)	3	8.8
Vesper Sparrow (Pooecetes gramineus)	1	2.9
Grasshopper Sparrow (Ammodramus savannarum)	26	76.5
Northern Cardinal (Cardinalis cardinalis)	2	5.9
Rose-breasted Grosbeak (Pheucticus ludovicianus)	1	2.9
Indigo Bunting (Passerina cyanea)	1	2.9
Western Meadowlark (Sturnella neglecta)	2	5.9
Yellow-headed Blackbird (Xanthocephalus xanthocephalus)	1	2.9
American Goldfinch (Spinus tristis)	5	14.7